WHAT IS CLAIMED IS:

1. A method of reducing noise and vibration in a switched reluctance motor drive comprising:

generating, by a computer, a phase current profile by:

initializing a plurality of profile parameters defining at least a portion of the phase current profile, the profile parameters comprising a current turn-off instant and a current turn-off profile defining the portion of the phase current profile after the current turn-off instant;

determining whether a desired torque is achieved based on operation of the switched reluctance motor drive using the plurality of profile parameters;

updating at least one of the plurality of profile parameters if the desired torque is not achieved;

initializing a radial force rate of change parameter mathematically related to the current turn-off profile;

calculating the current turn-off profile based on the radial force rate of change parameter;

determining whether the desired torque is achieved based on operation of the switched reluctance motor drive using the profile parameters, including the current turn-off profile calculated based on the radial force rate of change parameter; and

updating the radial force rate of change parameter if the desired torque is not achieved;

generating a phase current according to the phase current profile; and

applying the phase current to the switched reluctance motor drive.

2. A method of reducing noise and vibration in a switched reluctance motor drive comprising:

generating, by a computer, a phase current profile by:

initializing one or more first profile parameters defining at least a first portion of the phase current profile;

determining whether a first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters; and

updating at least one of the one or more first profile parameters if the first performance criterion is not satisfied;

generating a phase current according to the phase current profile; and

applying the phase current to the switched reluctance motor drive.

3. The method of Claim 2, wherein the first profile parameters comprise a current turn-off instant and one or more first profile components, each first profile component defining a portion of the phase current profile.

4. The method of Claim 3, wherein the first profile components comprise a reference current profile defining a portion of the phase current profile before the current turn-off instant, and a current turn-off profile defining the portion of the phase current profile after the current turn-off instant.

5. The method of Claim 2, wherein the first performance criterion comprises a desired torque.

6. The method of Claim 2, wherein the updating step comprises automatically increasing the at least one first profile parameter by predetermined increments.

7. The method of Claim 2, further comprising defining a maximum desired magnitude of radial force, and wherein applying the phase current to the switched reluctance motor drive produces a radial force having a magnitude less than or equal to the maximum desired magnitude.

8. The method of Claim 2, further comprising defining a maximum desired rate of change of radial force, and wherein applying the phase current to the switched reluctance motor drive produces a radial force having a rate of change less than or equal to the maximum desired rate of change.

9. The method of Claim 2, wherein generating the phase current according to the phase current profile comprises approximating the phase current to the phase current profile.

10. The method of Claim 9, wherein approximating the phase current to the phase current profile includes approximating the phase current to the phase current profile by hysteresis control and hard chopping.

11. The method of Claim 2, wherein determining whether a first performance criterion is satisfied comprises operating the switched reluctance motor drive and empirically measuring a performance characteristic of the switched reluctance motor drive.

12. The method of Claim 2, wherein determining whether a first performance criterion is satisfied comprises simulating operation of the switched reluctance motor drive.

13. The method of Claim 2, wherein generating a phase current profile further comprises:

initializing a change parameter mathematically related to at least one of the one or more first profile parameters;

calculating one or more of the at least one first profile parameters based on the change parameter;

determining whether the first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters, including the one or more first profile parameters calculated based on the change parameter; and

updating the change parameter if the first performance criterion is not satisfied.

14. The method of Claim 13, wherein the one or more first profile parameters comprise a current turn-off profile, wherein the change parameter comprises a radial force rate of change parameter mathematically related to the current turn-off profile, and wherein the step of calculating the one or more first profile parameters based on the change parameter comprises calculating the current turn-off profile based on the radial force rate of change parameter.

15. The method of Claim 14, wherein the radial force rate of change parameter is a constant.

16. The method of Claim 2, wherein determining the phase current profile further comprises:

initializing one or more second profile parameters defining at least a second portion of the phase current profile;

determining whether a second performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more second profile parameters; and

updating at least one of the one or more second profile parameters if the second performance criterion is not satisfied.

17. The method of Claim 16, wherein the one or more first profile parameters comprise a reference current profile, and wherein the one or more second profile parameters comprise a current turn-on profile defining the portion of the phase current profile before the reference current profile.

18. A method of determining a phase current profile for a phase current used in a switched reluctance motor, the method comprising:

initializing one or more first profile parameters defining at least a first portion of the phase current profile;

determining whether a first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters; and

updating at least one of the one or more first profile parameters if the first performance criterion is not satisfied.

19. The method of Claim 18, wherein the first profile parameters comprise a current turn-off instant, a reference current profile defining a portion of the phase current profile before the current turn-off instant, and a current turn-off profile defining the portion of the phase current profile after the current turn-off instant.

20. The method of Claim 18, further comprising:

initializing a change parameter mathematically related to at least one of the one or more first profile parameters;

calculating one or more of the at least one first profile parameters based on the change parameter;

determining whether the first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters, including the one or more first profile parameters calculated based on the change parameter; and

updating the change parameter if the first performance criterion is not satisfied.

21. The method of Claim 20, wherein the one or more first profile parameters comprise a current turn-off profile, wherein the change parameter comprises a radial force rate of change parameter mathematically related to the current turn-off profile, and wherein the step of calculating one or more of the at least one first profile parameters based on the change parameter comprises calculating the current turn-off profile based on the radial force rate of change parameter.

22. A switched reluctance motor system comprising:

a switched reluctance motor and a phase current applied to the switched reluctance motor, the phase current applied according to a phase current profile determined by:

initializing one or more first profile parameters defining at least a first portion of the phase current profile;

determining whether a first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters; and

updating at least one of the one or more first profile parameters if the first performance criterion is not satisfied.

23. The system of Claim 22, wherein the first profile parameters comprise a current turn-off instant, a reference current profile defining a portion of the phase current profile before the current turn-off instant, and a current turn-off profile defining the portion of the phase current profile after the current turn-off instant.

24. The system of Claim 22, wherein the phase current profile according to which the phase current is applied is further determined by:

initializing a change parameter mathematically related to at least one of the one or more first profile parameters;

calculating one or more of the at least one first profile parameters based on the change parameter;

determining whether the first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters, including the one or more first profile parameters calculated based on the change parameter; and

updating the change parameter if the first performance criterion is not satisfied.

25. The system of Claim 24, wherein the one or more first profile parameters comprise a current turn-off profile, wherein the change parameter comprises a radial force rate of change parameter mathematically related to the current turn-off profile, and wherein the step of calculating one or more of the at least one first profile parameters based on the change parameter comprises calculating the current turn-off profile based on the radial force rate of change parameter.

26. A switched reluctance motor system comprising:

a switched reluctance motor and a phase current applied to the switched reluctance motor according to a desired phase current profile, the desired phase current profile comprising a current turn-off instant defining a desired instant at which the phase current is turned-off and a current turn-off profile defining a desired decay of the magnitude of the phase current from the magnitude of the phase current at the current turn-off instant to zero, wherein the desired decay is less rapid than a natural decay of the phase current.

27. The switched reluctance motor system of Claim 26, wherein applying the phase current to the switched reluctance motor generates a radial force, and wherein applying the phase current according to the desired phase current profile provides an approximately constant rate of change of the radial force after the current turn-off instant.

28. The switched reluctance motor system of Claim 26, wherein the desired decay is approximately constant over time.

29. The switched reluctance motor system of Claim 28, wherein the desired decay comprises a plurality of decay steps.

30. The switched reluctance motor system of Claim 26, wherein the current turn-off profile has an approximately constant negative slope.

31. The switched reluctance motor system of Claim 30, wherein the approximately constant negative slope is defined by a plurality of steps.

32. The switched reluctance motor system of Claim 26, wherein the desired phase current profile further comprises a current turn-on profile defining a desired rise of the phase current from zero to a reference magnitude, wherein the desired rise is less rapid than a natural rise of the phase current.

33. The switched reluctance motor system of Claim 32, wherein applying the phase current to the switched reluctance motor generates torque pulsation, and wherein applying the phase current according to the desired phase current results in less torque pulsation than would result from a natural rise of the phase current.

34. The switched reluctance motor system of Claim 32, wherein the desired rise is approximately constant over time.

35. The switched reluctance motor system of Claim 32, wherein the desired rise comprises a plurality of rise steps.

36. The switched reluctance motor system of Claim 32, wherein the desired rise is approximately a mirror image of the desired decay.

37. A control system for use in a switched reluctance motor system, the control system operable to determine a phase current profile for a phase current used in switched reluctance motor, the phase current profile determined by:

initializing one or more first profile parameters defining at least a first portion of the phase current profile;

determining whether a first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters; and

updating at least one of the one or more first profile parameters if the first performance criterion is not satisfied.

38. The system of Claim 37, wherein the first profile parameters comprise a current turn-off instant, a reference current profile defining a portion of the phase current profile before the current turn-off instant, and a current turn-off profile defining the portion of the phase current profile after the current turn-off instant.

39. The system of Claim 37, wherein the phase current profile determined by the control system is further determined by:

initializing a change parameter mathematically related to at least one of the one or more first profile parameters;

calculating one or more of the at least one first profile parameters based on the change parameter;

determining whether the first performance criterion is satisfied based on operation of the switched reluctance motor drive using the one or more first profile parameters, including the one or more first profile parameters calculated based on the change parameter; and

updating the change parameter if the first performance criterion is not satisfied.

40. The system of Claim 39, wherein the one or more first profile parameters comprise a current turn-off profile, wherein the change parameter comprises a radial force rate of change parameter mathematically related to the current turn-off profile, and wherein the step of calculating one or more of the at least one first profile parameters based on the change parameter comprises calculating the current turn-off profile based on the radial force rate of change parameter.

41. A control system for use in a switched reluctance motor system, the control system operable to determine a desired phase current profile for generating a phase current used in switched reluctance motor, the desired phase current profile comprising a current turn-off instant defining a desired instant at which the phase current is turned-off and a current turn-off profile defining a desired decay of the magnitude of the phase current from the magnitude of the phase current at the current turn-off instant to zero, wherein the desired decay is less rapid than a natural decay of the phase current.

42. The control system of Claim 41, wherein applying the phase current to the switched reluctance motor generates a radial force, and wherein applying the phase current according to the desired phase current profile provides an approximately constant rate of change of the radial force after the current turn-off instant.

43. The control system of Claim 41, wherein the desired decay is approximately constant over time.

44. The system of Claim 41, wherein the current turn-off profile has an approximately constant negative slope.

45. The system of Claim 41, wherein the desired phase current profile further comprises a current turn-on profile defining a desired rise of the phase current from zero to a reference magnitude, wherein the desired rise is less rapid than a natural rise of the phase current.

46. The system of Claim 45, wherein applying the phase current to the switched reluctance motor generates torque pulsation, and wherein applying the phase current according to the desired phase current results in less torque pulsation than would result from a natural rise of the phase current.

47. The system of Claim 45, wherein the desired rise is approximately constant over time.

48. The system of Claim 45, wherein the desired rise is approximately a mirror image of the desired decay.

49. A switched reluctance motor system comprising:

a switched reluctance motor;

a neural network comprising a plurality of neurons connected by a network, each neuron having an associated weight, wherein the neural network is operable to receive one or more inputs and to output a desired phase current profile based on the inputs and the weights; and

a phase current applied to the switched reluctance motor according to a phase current profile output by the neural network.

50. The switched reluctance motor system of Claim 49, wherein the desired phase current profile comprises a current turn-off instant defining a desired instant at which the phase current is turned-off and a current turn-off profile defining a desired decay of the magnitude of the phase current from the magnitude of the phase current at the current turn-off instant to zero, wherein the desired decay is less rapid than a natural decay of the phase current.

51. The switched reluctance motor system of Claim 49, wherein the neural network comprises a plurality of layers including an input layer operable to receive the one or more inputs, one or more hidden layers each comprising one or more neurons, and an output layer operable to output the desired phase current profile.

52. The switched reluctance motor system of Claim 51, wherein the neural network comprises two hidden layers each comprising five neurons.

53. The switched reluctance motor system of Claim 49, wherein the neurons are activated using a tan-hyperbolic activation function.

54. The switched reluctance motor system of Claim 49, wherein the one or more inputs comprise a torque input and a rotor speed input.

55. The switched reluctance motor system of Claim 54, wherein the inputs further comprise an rotor angle input.

56. The switched reluctance motor system of Claim 54, wherein the neural network is operable to output a desired phase current profile for a plurality of operational points on a torque-speed plane.

57. The switched reluctance motor system of Claim 49, wherein the neural network is trained by a back propagation technique.

58. The switched reluctance motor system of Claim 49, wherein the neural network is trained by determining the weights associated with each neuron, wherein the weights are determined by:

operating the switched reluctance motor at a plurality of operating points, each operational point associated with a combination of test input values corresponding to the one or more inputs;

obtaining input data and output data from the operation of the switched reluctance motor at each operating point; and

calculating the weights using the input data and the output data.

59. The switched reluctance motor system of Claim 58, wherein each of the one or more inputs has an input value, and wherein the neural network is operable to determine by interpolation a desired phase current profile for a combination of input values unique from the combinations of test input values used in determining the weights.